Rural+

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RURAL+:

The plain, the beautiful, the sustainable in rural housing

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Part 2 prescribed examinations. Research themes investigated in the design studio include sustainable, low-energy communities and architectural language.

RURAL+:

The plain, the beautiful, the sustainable in rural housing

This paper explores the role of landscape aesthetics and sustainability in the development of new rural housing prototypes. Historically, rural building forms were largely influenced by immediately available materials, climate and specific use, resulting in regionally identifiable typologies. Changes in the way we live, proximity to place of work, and the relationship between home, community and land-use have resulted in rural domestic buildings losing specific regional distinctions. The aim of this research is to generate new spatial models of autarkic housing and alternative massing arrangements that respond to local landscape qualities, hybrid land-use, urban densities and local renewable energy production. The outcomes provide, semi-quantifiable spatial development prototypes that integrate these requirements within holistic conceptual frameworks for rural sustainable living providing alternative approaches to addressing Scottish policy legislation and a primer for further research. [133]

Keywords: Housing, Rural, Landscape, Design, Sustainability, Energy

Rural Sub-Urbanisation and the Scottish Context

With two-thirds of the world's population living in urban centres, it is not surprising that the city has been seen as the focus for grand societal changes in recent decades. [Carlow (2016)]. However, this ignores the impact of rapidly expanding urban areas on rural spaces and how these challenges affect both cities and their wider regions. The interdependency of the city on the countryside results in a number of impacts including population migration, city periphery expansion, resource extraction (water, food, energy, construction), and ecosystem pressures from tourism and leisure. This has detrimentally impacted the quality of the landscape, the sustainability of rural towns and villages and the resilience of rural life, and raises the question of how rural populations can live (and prosper) in a post-industrial urban society. As Carlow notes:

> 'the city-centred discourse becomes an almost self-fulfilling prophecy with cities becoming larger and better, more interesting and beautiful, whereas villages and small towns are more or less left to their own devices' [Carlow (2016)].

This question is particularly pertinent to Scotland which has long been defined by the beauty, distinctiveness and diversity of its landscapes, with its rural environment comprising 98% of its landmass but only 17% of the population [Scottish Government (2018)]. While superficially wild, remote and empty, Scotland's landscapes are in fact managed lands that have been shaped and maintained by people over generations. Historically, its regionally diverse geology and climate have given rise to a rich culture that has emerged in part due to specific relationships between people, place and the sustainable exploitation of natural resources and the working of the land. Traditional rural settlement and farming practices resulted in a great diversity of sustainable landscapes, giving clear legibility, visible character and identity to place and region. As sociologist and urban planner Patrick Geddes states:

> ‘Local character is thus no mere accident … it is attained only in the course of adequate grasp and treatment of the whole environment, and in active sympathy with the essential and characteristic life of the place’ [Corby (2014)]

Where in the past, the industrialisation of cities in the eighteenth century led to the depopulation of the countryside through mass out-migration, today rural communities in Scotland are facing different pressures. On the one hand there is the expansion of city peripheries through the acquisition of inexpensive farmland in accessible rural areas for new-build housing, and on the other there is the acquisition of houses and building plots in remote rural areas for retirement and second home ownership [Scottish Government (2018)]. As a result, rural populations in Scotland are growing, but at the expense of local people who can no longer afford to live in these areas due to rising land and property values and basic costs of living. As a consequence of these shifting demographics, traditional land use patterns, the social and economic makeup of communities and the physical form of towns and villages are rapidly changing, impacting the long-term resilience, sustainability and character of rural places and leading to the gentrification of many rural communities [Scottish Government (2018)].

The character of Scotland’s rural landscape is intrinsically influenced by its built infrastructure and extant regional vernacular architecture with its distinctive material use, grammar, climatically and materially responsive forms [Maudlin (2009)]. In the past, various social, economic and political initiatives have also been instrumental in further shaping the constructed landscape and defining the qualities of the Scottish

countryside. The Planned Villages[1] founded on Lotted Lands[2] by landowners on their estates during the eighteenth and nineteenth centuries are one of the most distinctive rural settlement types; a phenomenon unique to Scotland and Northern Ireland and one which distinguishes the Scottish and Irish rural landscapes from the rest of the UK [Lockhart (2001)] (Figure 1). Developed to build resilience in rural places and 'to improve land without expense and with certain profit' [Mitchison (1996)], they serve as early sustainable development models integrating people within the landscape in a more fundamental way. These and other later initiatives such as the Homes Fit For Heroes Act introduced in 1919 [Rosenberg (1975)], were designed to address specific social housing issues of their time but share among other things a common goal of raising the value of land through its productivity and contributing to the resilience of a local economy.

1 Between 1720 and the 1850's, 490 Planned Villages were characterised by a regular layout of streets, building plots and adjacent lands founded on large country estates. (Lockhart 2001).

2 Lotted lands were fields, typically subdivided into one- or two-acre lots, which were leased to villagers to grow crops and for grazing animals which were important when labouring and domestic industries provided insufficient employment. For the landowner, it provided a mechanism to raise the value of impoverished land through its continual working and returned a feu to the estate (Lockhart 2001).

Figure 1. Forres, a typical planned village in Morayshire, Scotland [Modified from Ordnance Survey (1855-1882)]

Today, most housing provision in Scotland, particularly in accessible rural areas, is driven by speculative development which is led by commercial sector developers and volume house builders. These largely standardised private housing types, development morphologies and construction systems result in a one-size-fits-all socio-economic and market driven model. This is more concerned with housing than homes, and individuals over communities, where the physical relationship between house, plot and neighbourhood serve the needs of a 'notional family unit' and a suburban lifestyle. The physical outcomes of this approach are similar irrespective of place, social and economic need, and the broader impacts development forms of this type have in relation to ecology, place, people, resource use and the long-term sustainability of the environment (Figure 2). With housing accounting for nearly one third of all energy consumption, it also has a significant role to play in reducing reliance on carbon-intensive generation while sustaining living standards and managing the protection of natural resources [DECC (2014)]. These are factors that are significantly exacerbated in rural contexts with their historical reliance on imported coal, oil and gas for heating and hot water, with current development practices continuing to perpetuate high carbon planning models.

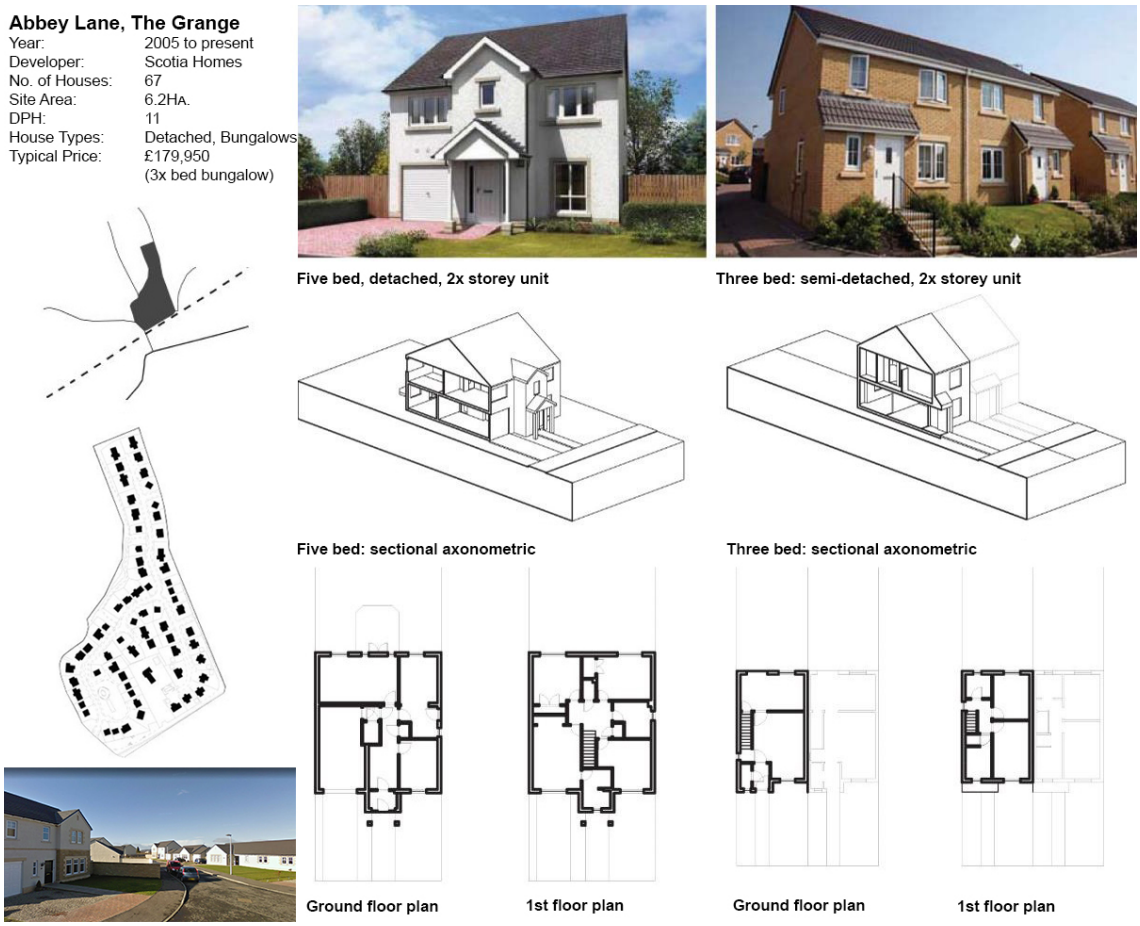


Figure 2. Typical contemporary development near Errol, Carse of Gowrie

These issues have been recognised to an extent in more robust planning legislation introduced to control the quality of development in rural areas and more onerous energy efficiency standards to improve building fabric efficiency and encourage the adoption of Low and Zero Carbon Generating Technologies (LZCGTs) [Scottish Government (2013)]. However, these material and technical design considerations are only one aspect of resource efficiency. The design, form and aesthetics of housing and its relationship to people, place and work, is fundamental in creating sustainable low-carbon communities. Appropriate rural housing is fundamental for the establishment of an integrated economic and sustainability framework that is needed to achieve low carbon regions, as first proposed by Patrick Geddes in The Regional Plan in 1909 and in his ‘Valley Section’ concept [Mellor, (1990)].

There are now strong arguments to radically rethink current practices due to the disaggregation between planning approaches, carbon abatement, energy efficiency and design quality policies at regional, local and applied scales. It asks questions of what alternative development practices, housing typologies and spatial morphologies are required in order to fully integrate built infrastructure and people within a regional, low-carbon strategy, and also how to deliver the equitable and sustainable low-carbon rural neighbourhoods and communities that we need to take us through the 21st century.

This paper explores these issues through the examination of a conceptual case study for a new autarkic rural housing community at Cottown in the Carse of Gowrie, Scotland. Three alternative architectural planning prototypes are proposed for sustainable, low-energy rural housing which are distinguished by their development forms, spatial arrangements, higher density planning, hybrid land-use, alternative house typologies, local renewable energy provision, formal language and material grammar. Responding to regional land-use characteristics the approaches attempt to illustrate how future rural housing could be developed using more embedded sustainable practices and foster a greater 'sense of place'. **[1335]**

Sustainable Place-Making

The driver behind the need for 'sustainable' development is to mitigate the impact that predicted climate change will have on our cities, land uses and infrastructural systems. Additionally, as people's requirements change, throughout their lives and from one generation to the next, developments that can accommodate individual, collective and cultural diversity without undue impact on the environment will be richer places to live. In June 2014 the Scottish Government published its National Planning Framework 3 (NPF3) [Scottish Government 2014a] and updated Scottish Planning Policy (SPP) [Scottish Government 2014b] documents which set out

the spatial development priorities and the policies to deliver them over the next 20 – 30 years. The outcomes are designed to deliver a "more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth" [Scottish Government 2014a]. The development outcomes to help realise this ambition, are stated as being: *a successful, sustainable place; a low carbon place; a natural, resilient place and a more connected place*. In all of these outcomes, 'place' is the key recurring development theme. Good quality places, in their widest sense, are the foundation to our well-being on both a societal and individual level. With Scotland's population predicted to increase by 5.3% from 5.40 million in 2016 to 5.69 million by 2041, the solutions for meeting housing demand need to be integrated with alternative approaches to land use and public space to correspond with the aims for successful places [National Records of Scotland (NRS), (2017a)].

A range of specific policy documents have been developed to facilitate the SPP and provide additional design and performance guidelines. Foremost amongst these are: Creating Places: A policy statement on architecture and place for Scotland [Scottish Government (2013)] and Designing Streets: A Policy Statement for Scotland [Scottish Government (2010)]. These are supported by various Planning Advice Notes (PANs) which provide best practice guidance. PANs relevant to rural housing include: PAN 44: Fitting new housing developments into the landscape, [Scottish Government (1994)], PAN 65: Planning and Open Space, [Scottish Government (2008)], PAN 72: Housing in the Countryside [Scottish Government (2005)] and PAN 83: Master Planning, [Scottish Government (2008)]. Additional housing-specific reports which identify structural, policy and design issues around housing specifically include: Firm Foundations - The Future of Housing in Scotland [Scottish Government (2007)], Housing: Fresh Thinking New Ideas [Scottish Government (2010)] and Homes Fit for the 21st Century: The

Scottish Government's Strategy and Action Plan for Housing in the Next Decade: 2011-2020 [Scottish Government (2011)]. 'Fitting Landscapes' introduced by Transport Scotland in 2014, while providing a policy statement for the design of transport infrastructure is relevant in that it provides a qualitative framework for transport interventions in the landscape that recognises the need to value local distinctiveness, conserving and enhancing areas of high quality or, where appropriate, creating positive contrast [Scottish Government (2010)].

While these policies and previous studies have defined built form through analysis of specific formal attributes [Steadman et al. (2000)], this study considers the relationship between built form and local context and how alternative conceptual design prototypes can be developed that respond to specific landscape qualities, renewable (local) energy generation, higher density planning and integrated land-use. [525]

Sustainability and landscape aesthetics

The post-modern landscapes of the late 20th and early 21st centuries are characterised by the unprecedented pace, scale and superimposition of changes to the landscape. This is defined principally by a definitive break from past traditions, a result being a loss of ancestral roots, diversity, coherence, identity, and the environmental and aesthetic deterioration of the landscape [Antrop (2005)]. The many spatial arrangements that defined specific characters of former landscapes and which gave them unique and individual appearances are being lost, with contemporary interventions leading to a widespread weakening of the perceptual aesthetic conditions [Nohl (2001)]. Antrop argues that the 'value' of historical landscapes is in the embedded (as yet uncovered) knowledge of sustainable practices that might influence our landscapes of the future [Antrop (2005)]. Maintaining diversity and identity are key cultural values necessary for the preservation of historical landscapes, and while landscapes of the past cannot be

brought back, it is important to find ways in which remaining existing valuable elements and areas can be preserved and become embedded functionally in a modern urbanized and globalized society. To retain the remaining vestiges of historical landscapes, he suggests that coherence between small composing (historical) landscape elements within a broader spatial context is needed. This is important for the legibility of future landscapes as these preserved elements give the ability to tell the (his)tory of a place strongly enhancing the identity and the landscape's overall value.

Gobster et al. investigates the relationship between ecology and aesthetics and how landscape planning, design and management can address the aesthetics of future landscape patterns and help protect and enhance ecological goals [Gobster et al. (2007)]. They argue that because human impacts on ecological processes have undermined numerous essential and beneficial ecosystem services, (from functional attributes to landscape beauty), we need strategies for making decisions that bring human values and ecological goals into better alignment. They propose a conceptual model of landscape aesthetics and ecology in which environment and behaviour are defined as transactional and contextual (Figure 3). It shows how human interactions with landscape and how different landscape contexts affects aesthetic experience and how aesthetic experience can be a driver of action and change. Importantly in the context of this research, they define agricultural landscapes as 'aesthetics of care and the effect of knowledge', in which displays of order and stewardship are perceived as being in harmony with nature. Aesthetics of care are defined as being the perceptible cues of human presence; engagement in the landscape and social gestures of neighbourly consideration.

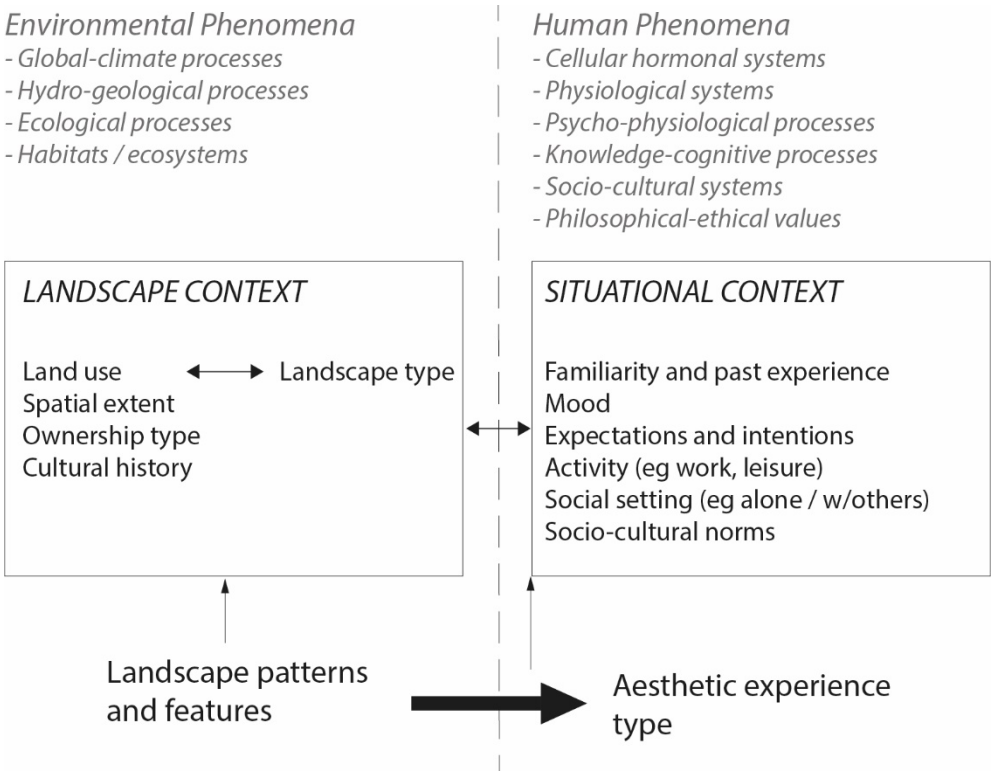


Figure 3. Context component to model human-environmental interactions in the landscape [adapted from Gobster et al. (2007)]

Nohl examines sustainable landscape use and aesthetic perception as a cognition process, determining basic aesthetic perceptual categories as: *the beautiful*, *the (new) sublime*, *the interesting* and *the plain*, defining these in terms of their narrative and poetic effects. From this he defines the most important aesthetic prototypes of future landscapes; *the traditional cultural landscape*, *the succession landscape*, *the urban/industrial landscape* and *the rural functional landscape*. He proposes that new landscapes are likely to take the form of hybrids of these types, nuanced by the influence of regional and local variations including; physical, social, cultural, ecological and/or economic factors, into a multiplicity of single landscapes [Nohl (2001)]. In the categorization, the definition of the 'traditional cultural landscape' and the 'plain landscape' are most relevant to this study (Table 1). **[566]**

Aesthetic perceptual category	**Narrative aspects of:** *Landscape as aesthetic percept (expressive and symptomatical effects of landscape)*	**Poetic aspects of:** *Landscape as aesthetic percept (expressive and symbolical effects of landscape)*	**Landscape prototype**
the beautiful	Culturally caused typical patterns of order, consisting of natural and man-made elements, allowing an easy recognition	- Blissful feelings (eudaimonic feelings) of harmony, identity, of being a part of a whole; - Symbol of 'home' safety, and of being socially integrated.	**Traditional cultural landscape** (eg preservation /restoration of historical practices, also for tourism/historical interest and a 'utopian surplus')
the plain	Simple course meshed patterns, with repetitive, yet rich and natural (sub-dividing) structures	- comforting feelings of contentment, of gratitude; - Symbol of existential usefulness, of the reconciliation of technical progress with nature.	**Rural functional landscape** (eg modern agricultural landscape, and future functionally determined, sustainably organised landscapes for food, production, transport, energy)

Table 1. Aesthetic perceptual categories under sustainable landscape conditions [adapted from Nohl (2001)].

Sustainability and Renewable Energy Generation

Nohl's categorization of 'the plain' landscape suggests the development of future (yet to be conceived) sustainable landscape prototypes. These would be organised according to sustainable principles for food production, transport networks and energy generation. New ideas emerging from central Europe, driven by local and regional energy self-sufficiency may point to one such approach for developing new integrated sustainable landscape models.

Energy autarky is the ability to meet energy demand through regional renewable sources of energy, saving energy, and using energy more efficiently [Abeg (2011)]. It is a strategy for dealing with both climate change and energy security using regional ecosystem resources to the benefit of the local society, environment and landscape. Energy autarky can thus be described as a location that relies on its own energy resources for generating the useful energy required to sustain the society within that region or a situation in which a region does not import substantial amounts of energy

resources [Owens et al, (2014)]. The concept can be applied at individual building, community and regional scales and employs technical solutions to optimise energy generation, energy storage and control technologies to achieve self-sufficiency. As such it can be used to strategize planning based on renewable energy generation and low-carbon resource availability at regional levels, and in determining the location, scale and nature of new development based on the sustainable and economic use of local and regional low-carbon energy sources. Functioning autarkic energy systems typically require a micro-grid, defined energy demand and supply characteristics, opportunities for energy storage and controls able to manage the harmonization of system components [Owens et al., (2014)].

A number of European regions are developing strategies for energy autarky including Güssing, Austria; the Jühnde, Germany; Samsø, Denmark and the Island of Eigg in Scotland. These pioneer areas are leading the way, not merely to eliminate energy imports, but also to use energy economically and efficiently, meet their own demand as far as possible with renewable energies, and at the same time stimulate the regional economy [Abeg (2011)]. Often, the objective of becoming a carbon-neutral region is closely linked with this economic goal as revenue from net energy export can be used to re-invest in social infrastructure, growth of local sustainable enterprise, investment in affordable housing with reduced energy requirements and improved agricultural production [Zammer, (2005)]. Sustainable low or zero-carbon energy can be the economic catalyst for practically delivering autarkic sustainable communities in the broadest sense. This may well be one solution to developing robust regional rural economies, viable affordable rural housing and sustainable rural living practices in Scotland. **[430]**

Sustainability and Density

In FARMAX: Excursions on Density 'Greyness on the Dutch Mesa' [Koek et al. (1998)], Koek, Maas and Rijs note the impact of unplanned (low) density development in the Netherlands:

> "The country can steadily be regarded as a city-state, a northern Monaco of sorts, filled with this low density urban matter lacking a clear form of organization, consisting as it does of development that has to be varied all over and, perhaps as a result, ends up looking the same. This urbanity is more concerned with quantity than quality…an urban matter that cannot be considered entirely valuable…and continuing the present trend will cover most areas still open and envelop our entire society in a 'greyness'" [Koek et al. (1998)]

Koek highlights the deleterious outcomes of spontaneous, non-designed (as opposed to unplanned) landscape spaces. Meyer argues that it is not enough to design landscapes that incorporate best management practices and that are measured in terms of ecological health, social justice and economic prosperity alone, but that we need new 'designed' sustainable landscapes that are both constructed human experiences and ecosystems [Meyer (2008)]. She maintains that while we are sustained by reducing, editing, doing less badly, we are also sustained, and regenerated, through abundance, wonder, and beauty. The performance of a landscape's appearance, and the (aesthetics) of beauty, should have as much currency in debates about what a sustainable landscape might, and should, be as the performance of its ecological systems.

FARMAX proposes new aesthetic and functional models containing an extreme urbanism of consolidation, programmatic density, spatial compaction and concentrated land use. The new models and forms of development are based on Floor Area Ratio (FAR): the maximisation of the ratio of gross floor area of a building to the total size of its plot thereby unlocking a site's potential through releasing plot area for other economic, social or sustainability enterprises. With mixed economics and in some cases

new hybrid-typologies of urban and agricultural zoning, they offer a potential step change in addressing climate change and human resource use. At one level the FARMAX approach provides richer spatial potentials that go beyond simple two-dimensional zoning of land. They also consider a broader and more integrated approach to sustainability that could give clearer definition, structure and identity to the planned built, the traditional cultural and modern functional landscapes. **[387]**

Research Aims and Methods

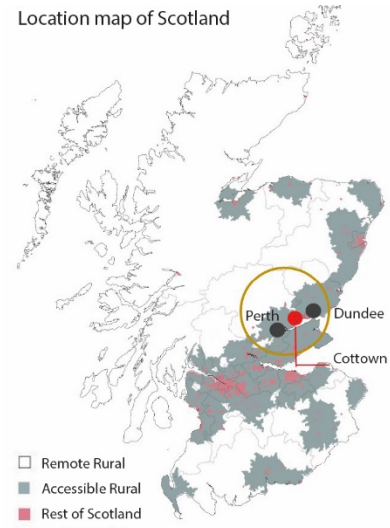
The aim of this research is to generate new spatial models of autarkic housing and alternative massing arrangements that respond to local landscape qualities, hybrid land-use, urban densities, and local renewable energy production. The outcomes provide semi-quantifiable spatial development prototypes that integrate these requirements within holistic conceptual frameworks for rural sustainable living, providing alternative approaches to addressing Scottish policy and legislation and a primer for further research. The methodology is based on work by RIBA/CABE in their study of future housing predictions 'Housing Futures 2024' [Worthington, (2004)]. The research has been a mixed methods approach with the design process forming a major part of the research method. It is informed by quantitative data and provides the means by which data was generated for analysis. Design is an iterative process in which the implications of different decisions are weighed against each other in an informal evaluation process, until an optimum solution is arrived at. The criteria used in design development are typically both quantitative and qualitative in nature and the relative importance of each issue is often open to the personal bias of the designer. In light of this inherent subjectivity the designs were tested against specific quantifiable measures to give resistance to the decision-making process, which included energy performance, density and floor areas. The scope of the research, developed in collaboration with industry

stakeholders and specialist consultants, addresses the relationships between affordability, energy security, food cultivation, sustainable construction techniques, regional identity and spatial quality. **[248]**

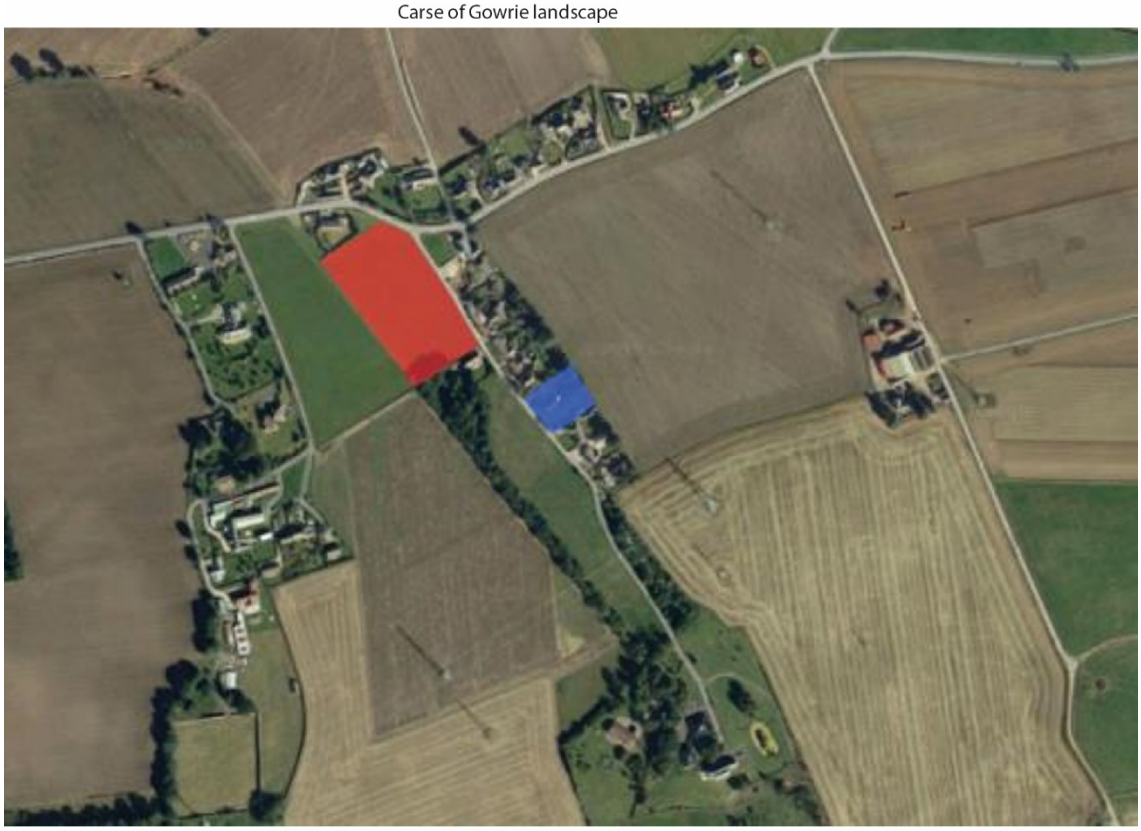
Research Context

The majority of predicted population growth in Scotland is anticipated to be in Accessible Rural areas, the definition of which is settlements of less than 3,000 people and within a 30 minute drive of a settlement of 10,000 or more (Scottish Government, 2018). Classed as Accessible Rural, the Perth & Kinross region is expected to encounter an increase of 18% in the number of households by 2041. This will have significant implications for housing demand and type in this area, as the number of households is projected to increase faster than the population as the need for large family homes decreases, and people increasingly live in smaller households (National Records of Scotland 2018). The problem is compounded by the relationship between higher than average property prices, and lower than average annual salaries in Perth & Kinross when compared to national statistics. In addition to this, nearly a third of households in Accessible Rural areas are classed as 'fuel poor', where fuel poverty is defined as a household being required to spend more than 10% of its income on all household fuel use (Scottish Government 2019). A large proportion of rural areas are not connected to the gas grid, relying on electricity, propane gas or oil for space heating and hot water. Households off the gas grid experience higher than average fuel costs and higher levels of fuel consumption due to exposure to harsh weather conditions and regional variations in fuel cost, directly impacting on living standards (Scottish Government 2018). The Perth & Kinross area offers an appropriate context for testing alternative development practices which promote the integration of people, buildings and low-carbon strategies.

The Carse of Gowrie is an area of low-lying agricultural land, small towns and hamlets sitting along the banks of the River Tay between the cities of Dundee and Perth. It has a long history of being self-sustaining through thriving agriculture, renowned orchards and locally sourced materials, its southern aspect and low rainfall offering ideal growing conditions making it prime high value agricultural land (Figure 4). The Local Development Plan identifies potential development sites for the provision of housing and employment through expansion of existing settlements to strengthen infrastructure and networks. Development sites have been identified which reinforce the ribbon development which forms the village of Cottown, a small collection of houses distributed along two minor roads approximately 8 miles to the east of Perth. The larger of the development sites, at approximately 0.9 hectares, is located to the north west of the village, with existing houses to the east and agricultural land typical of the area to the west. Orchards were first planted in the area by Cistercian monks in the 12th century with production from over 50 commercial orchards reaching its peak in the early 19th century. There is a particularly high concentration of surviving mud wall structures in the area due to the drier climate on the east of Scotland. The success of local industries brought an influx of workers and their families to the area, resulting in an urgent need for housing, the solution being to use locally sourced clay, timber and Tay River reed thatch, a sustainable method of construction which is synonymous with the Carse of Gowrie. The Old Schoolhouse, one of the surviving mud wall structures in the area, influenced research into the development of contemporary sustainable communities which address land-use as well as built form, assessing local planning policies in relation to housing with the aim of developing strategies for the hamlet based on autarkic principles. **[589]**



Carse of Gowrie landscape



Hamlet of Cottown showing Old School House site (Blue) and development site (Red)

Figure 4. Carse of Gowrie typical view of the agrarian ‘cultural landscape’ and location plan indicating development site at the hamlet of Cottown.

Results

Energy Generation

Research into existing Scottish Government legislation regarding fuel poverty and micro generation identified a secure, renewable strategy for the Cottown proposals through establishment of a low carbon community energy generation structure. Research led to a micro CHP plant using local reeds as a fuel source as the most appropriate low-carbon option in that it offered economic and social benefits in addition to efficient energy generation. The Tay Reed Bed is home to rare species of birds and insects and requires cropping annually to sustain this fragile ecosystem. Each hectare of reeds can produce 5 tonnes of dried matter annually, which provides a potential energy content of 21MWh/t/Ha, making the potential for reeds as a fuel source for a CHP plant in conjunction with thermally efficient housing a viable proposition [Komulain et al., (2008)]. Bailing the reeds, as opposed to transporting the reeds to England for compaction into pellets, would reduce carbon emissions, promote local employment and contribute further to the local economy. By sizing the CHP plant to meet the heat demand of the proposed housing, a surplus in electricity is generated which can be exported to the National Grid and could generate up to £12,000 per annum in Feed-In Tariffs. This sum could be used for community use, in employing a manager to run the CHP system, reducing bills, or reinvesting in community facilities. Three standards of fabric efficiency were analysed: Code for Sustainable Homes Level 6 at 46 kWh/a m2; Code for Sustainable Homes Level 6 + Mechanical Ventilation and Heat Recovery (MVHR) with airtightness to Passivhaus standard at 34 kWh/a m2; and Passivhaus at 15 kWh/a m2, which was used to calculate the number of units/developments that could be supplied with sustainable energy. **[289]**

Procurement

The National Records of Scotland relates dwellings per hectare (DPH) to urban/ rural classifications, defining them as: Remote Rural < 10 DPH; Accessible Rural 10-25 DPH; Urban 25-50+ DPH. A contextual analysis of existing suburban housing developments in the local area determined the economically viable model to be 20-25 DPH, which corresponds with the NRS data for Accessible Rural (2015). To test an alternative to the developer approach of distributing 20-25 units evenly across the 0.9 hectare site as individual plots, a design strategy was developed to increase the density of housing to urban levels over part of the site, allowing the remaining site area to be used for shared community facilities, subsistent farming practices and sustaining wildlife. In increasing the density to 40 DPH over a reduced development footprint, a significant proportion of the 0.9 hectare site could be released for alternative use.

The strategic proposals investigated the possibility for like-minded individuals to lead housing procurement as a group, thereby directing funds into raising spatial design quality rather than forming the developer's profit, and through shared facilities reduce the costs of essential services. Alternative procurement methods were investigated which allowed the opportunity to re-evaluate the relationships between public and private realms, shared/community spaces and private gardens with all proposed house types offering defined, private external space as well as access to shared areas.

Developing the site to an urban density led to consideration of how to resolve the massing, formal and spatial issues in a rural location of high aesthetic landscape value and creating an identity for the development that responded to and intensified the intrinsic aesthetic relationships between built form and landscape particular to the Carse of Gowrie context. **[282]**

Identity

Historically, rural building forms were largely influenced by immediately available materials, climate and specific use, resulting in regionally identifiable typologies. Maudlin noted that in Scotland traditional single storey dwellings with walls of mud or stone and roofs of thatch or turf were "integrated structures within the landscape" in that they were directly connected to the land through material, orientation and form [Maudlin, (2009)]. More recently, however, characteristics of rural domestic buildings have lost specific regional distinctions due to the mono-cultural suburban residential model currently implemented by volume house-builders in Scottish rural areas. Unlike the regional characteristics apparent in traditional rural buildings, suburban development follows an essentially predefined development strategy irrespective of where it is implemented geographically. This type of development is having a detrimental impact on areas such as the historically significant Carse of Gowrie, where existing characteristics are at risk of being lost as housing development follows a generic architectural language.

As well as over 40 examples of mud wall construction in the Carse of Gowrie area, more recent typologies with specific rural characteristics include the range of buildings which characterise large country estates and farms. The farm typology is a hybrid of key buildings of different scale and hierarchy, with particular relationships to the form of the landscape in terms of topography and orientation. The detached farm house, steading clusters protecting working courtyards, walled gardens, row housing, agricultural barns and silos all retain particular architectural qualities representative of their location and use (Figure 5). In testing urban densities, the strategic designs explore larger mass in the landscape which corresponds in character to the local farming typologies rather than that of individual detached homes. The larger built forms could better define external shared areas, creating enclosed space with appropriate exposure to

sun and protection from prevailing winds, responding to the Perth & Kinross Local Development Plan's emphasis on the relationship between design, density and character of place (2014). **[320]**

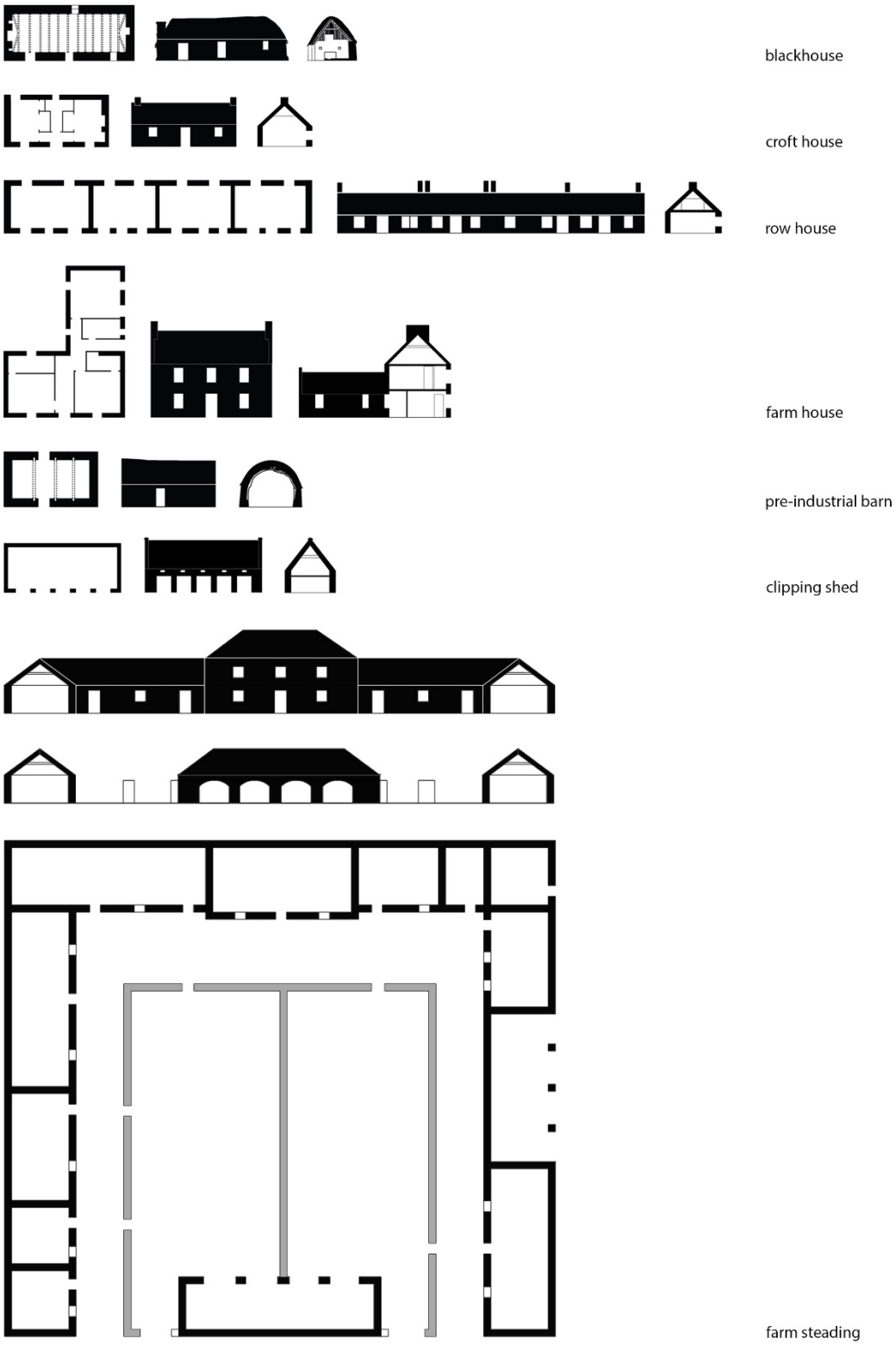


Figure 5. Historical Scottish rural building domestic and non-domestic types typical of agrarian cultured landscapes.

Design Proposals

Research and analysis of existing types in the Cottown area, specifically the agricultural barn, walled garden and farm steading, was carried out to identify key characteristics and principles for use in generating place-specific proposals in response to generic volume house development. Taking inspiration from the regional sustainable building traditions exemplified by the existing mud wall and thatch Schoolhouse and the key characteristics of existing rural building types, the research led to three spatially differentiated concepts integrating energy autarkic solutions, with higher density planning and new regional languages that respond to the unique landscape of the Carse of Gowrie: Skinny Barn; Community Farm; Walled Garden (Figures 6-8).

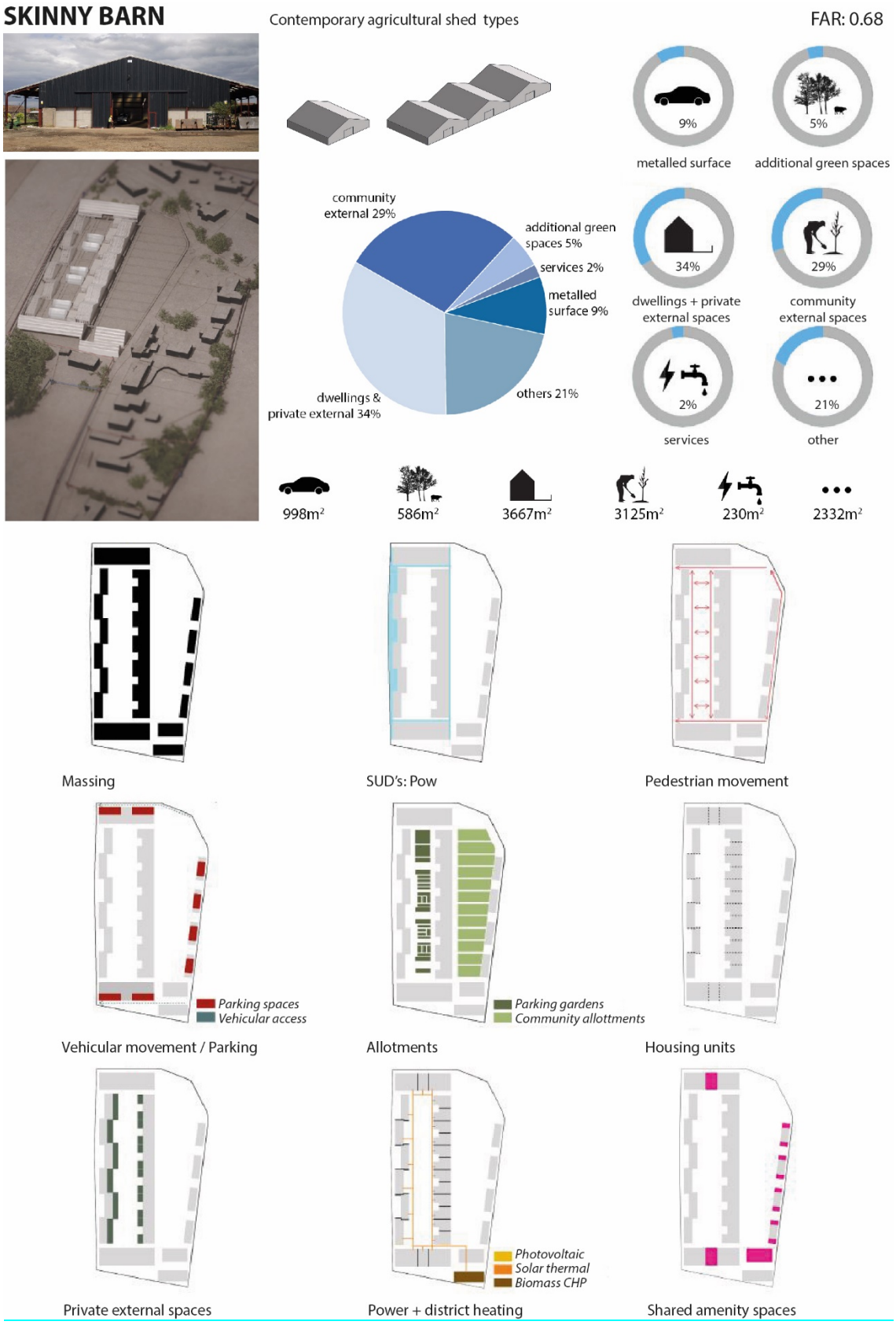


Figure 6. Skinny Barn development proposal type showing breakdown of infrastructure and landscape use.

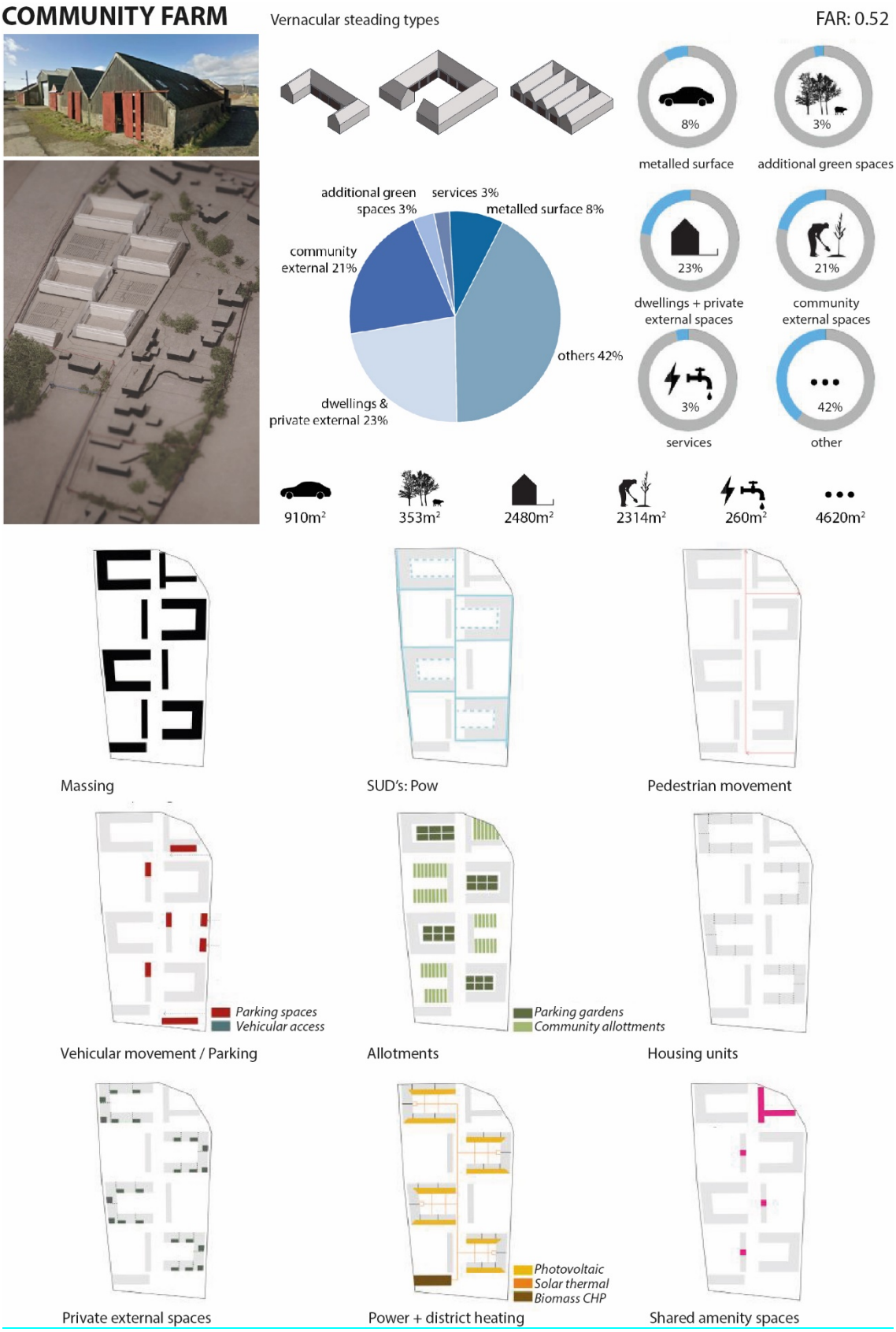


Figure 7. Community Farm development proposal type showing breakdown of infrastructure and landscape use.

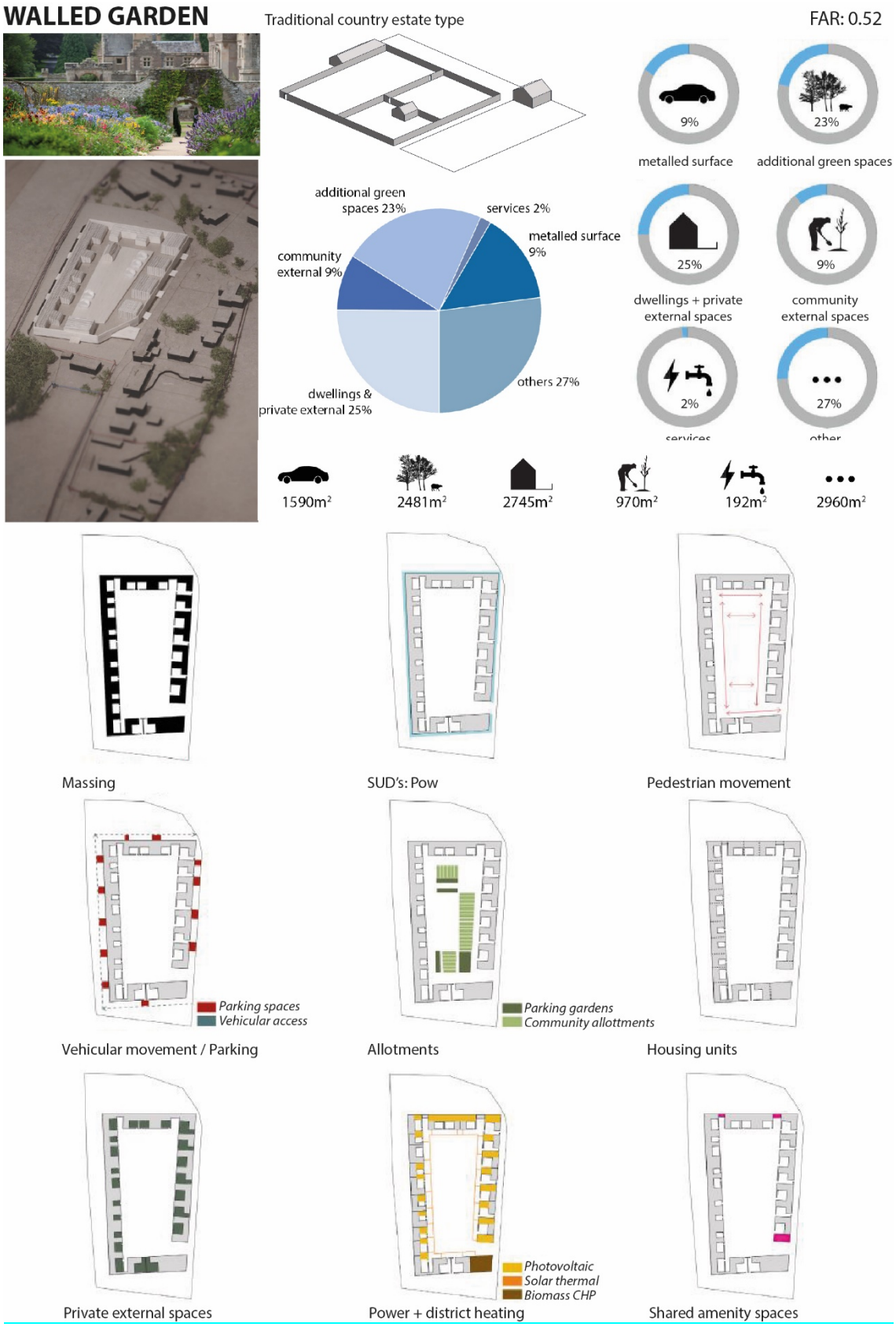


Figure 8. Walled Garden development proposal type showing breakdown of infrastructure and landscape use.

Skinny Barn

The Skinny Barn proposal investigates the typology of the regionally identifiable agricultural barn, allowing for higher housing density to be achieved while maintaining a recognisable rural language. The built form is located to the west of the site, releasing land for cultivation towards the east. A protected, car-free, courtyard forms a series of controlled spaces between the varied house types, offering shared greenhouses, raised planters, seating, play areas, tool storage and main entrances to all houses. These pockets of external space relate to activities in the different house types forming the perimeter - the living spaces of the 3 and 4 bedroom types, and the shared facilities located at the entrances to the courtyard. Vehicular access is limited to the north and south edges of the development, with car parking located below maisonettes, maximising pedestrian ownership of the site. Pows, drainage ditches common to the area, define the built form in the landscape and separate public and semi-public areas. The land released to the east of the development site as a result of the higher density approach offers allotments and tool storage for use by the existing Cottown community as well as those living in the new development, connecting the existing and new communities (Figure 6).

Community Farm

The Community Farm proposal integrates housing with glasshouses, the built forms protecting and defining areas for cultivation of food. The u-shape forms repeated across the site create a more private courtyard for family use with a direct relationship to ground floor living spaces, while the spaces between the built forms frame the areas for growing crops. Lean-to glasshouses sit at the gable ends of the housing, inspired by traditional Edwardian and Victorian examples in using the thermal mass of the supporting wall to contribute to sustaining higher temperatures for growing. The

glasshouses have several key purposes: the annual growing period is extended, and crops which may not survive outdoors can be cultivated for home consumption; the intakes for the MVHR system are located in the glasshouses, so pre-heating the air and reducing the amount of energy required to get the air to ambient temperature; and semi-outdoor spaces are offered as an extension to the living spaces, offering an alternative 'winter garden' for the inhabitants. Vehicular access is limited to the edges of the development, keeping the family courtyards and growing areas car-free. The pitched roof forms reference agricultural buildings in the area, with pows reinforcing the reading of each form in the landscape, ensuring the mass is comparable with existing buildings in the area (Figure 7).

Walled Garden

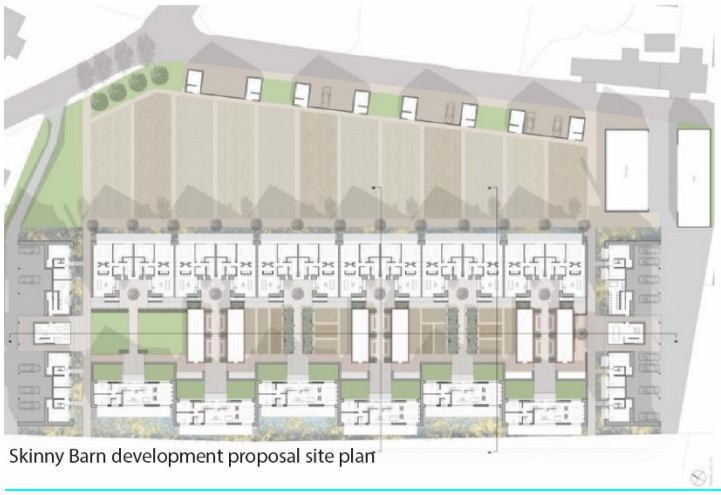
The Walled Garden proposal is directed by one of the characteristic elements of landed property in the Carse of Gowrie, forming a contemporary reinterpretation of the walled garden typology. Substantial country estates in the area included various forms of enclosed gardens for cultivation, social activities and education. As country estates have diversified and reduced in scale, new buildings have been located within walled gardens to accommodate a range of private or commercial uses while the perimeter wall remains a constant, recognisable element in the landscape. The proposal places individual houses in a row to generate the perimeter wall, the collective mass creating a recognisable form in the landscape, enclosing and protecting a secluded space for subsistent living, community use and the reintroduction of the orchards which were historically prevalent in the Carse of Gowrie. The envelope formed by the row houses conceals the garden at the heart of the development, from which the natural horizon is only glimpsed at specific points. The enclosed garden becomes the primary focus, an external room of a different scale to the rural landscape. Vehicular access is limited to

the external perimeter of the wall, with each house having an associated parking area on the bridge crossing the pow, adjacent to the main entrance. Pows running round the perimeter of the boundary wall emphasise the reading of the wall as an object in the rural landscape, giving the development identity and mass when viewed from a distance to relate to existing rural forms (Figure 8). **[828]**

CONCLUSION

With the built environment contributing to 37% of carbon emissions, fuel poverty in rural Scotland reaching up to 40% in some areas, and a net annual shortfall of 574 affordable houses in the Perth and Kinross area alone, there is an urgent need for more innovative solutions to the problem of housing provision. The future sustainable, equitable, low- and zero-carbon communities that will be required to deliver this need alternative forms of housing of all tenures with mixed land uses and economies that are simply not provided by the current mass-market housing mix. A deeper understanding at regional and individual levels of the underlying cultural, environmental and economic requirements of communities may generate more appropriate development frameworks and architectural responses to low-carbon rural living (Figure 9). Autarky principles emerging from central Europe offer a possible answer to the challenge of rural housing in that low-carbon energy self-sufficiency can catalyse sustainable economic development providing resilience and the necessary economic means for inward investment in local community infrastructure whilst contributing to regional energy generation requirements through renewable energy exports. However, this will require reconsideration of policy and regulation at national and regional levels across planning, building regulations and procurement policy.

Skinny Barn development proposal in context



Skinny Barn development proposal site plan

Skinny Barn visualisation of typical house type

Skinny Barn development proposal model

Figure 9. Visualisation of built form, external spaces and land use in the Skinny Barn proposal.

Changes in some areas are being made, and the presented research supports recent changes in Government legislation which cater for an alternative market to developer-led speculative development. Scottish communities now have the opportunity to use the Community Right to Buy process under the Community Empowerment (Scotland) Act 2015 [The Scottish Government (2015)] to form a collective body and apply to develop land, buildings and spaces to meet the needs of local inhabitants. As communities rather than individuals or companies begin to buy larger pockets of land for development, procurement methods and forms of housing will need to diversify.

These changes offer a people-led alternative, similar to more established central European examples such as the German Baugruppe model where like-minded individuals form ‘building groups’ to develop community-orientated housing with shared facilities. These are inherently more sustainable in use of material resources and land use, and the community-led approach can offer ownership of public space with the potential to create the successful places Scottish government policies intend.

The research defined three alternative development morphologies derived from traditional and contemporary rural infrastructure types, namely: the 18th Century ‘Farm Steading’, the ‘Country Estate’ and the contemporary steel framed ‘Agricultural Shed’. Historical and contemporary rural building forms and landscape use are by necessity characterised by economy in their material use and development footprint and result in distinct aesthetic relationships between built form and open space. Whilst the proposals for this small development site at Cottown in the Carse of Gowrie take different formal approaches, a number of common architectural issues have emerged from the study. Density and intensive use of land are needed to create clearly defined hierarchies and high-quality external spaces. In all schemes, clustering of the built fabric allows very precisely defined public space with clear boundaries and thresholds whilst achieving higher densities than suburban models. The perception of enclosure (and therefore density) is generated by the boundary walls and drainage pows. A more intensive use of land pockets relieves pressure on remaining land which can be released for alternative uses: green-space; wildlife corridors; swales; waterways; farming and allotments. An ordered landscape framework based not on the primacy of the car, but on alternative land uses can achieve a scale of association with the existing rural landscape with built densities more in-keeping with the existing village and surrounding non-domestic agricultural infrastructure and offer sustainable ways of living and working. Of the three

development morphologies proposed, Skinny Barn and Community Farm are arguably the most successful in integrating built form and community spaces in new aesthetic relationships more in keeping with the rural context. The Walled Garden proposal, with its dense external boundary of terraced houses is more polarised in its spatial configuration resulting in a more urban character and aesthetic more suited to suburban or city edge contexts.

This paper has explored the spatial development of new rural housing models in addressing more sustainable approaches to living in near rural contexts in landscapes of high historical and sustainability value. While the work focuses on the Scottish context and examines the aesthetic conditions of a regional landscape and the policy frameworks that surround this, the use of creative practice research methods that combine qualitative design studies with semi-quantifiable analysis are likely to be broadly relevant across a wide spectrum of contexts. The value in the work is the ability of the method to allow alternative formal models to be assessed on their individual aesthetical and social attributes and how these can contribute to the development of new integrative and holistic sustainable frameworks for rural housing provision.

[6605 Total Word Count]

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